UNIVERSITY OF ARKANSAS COTTON BREEDING PROGRAM - 2001 PROGRESS REPORT

Fred M. Bourland[1]

RESEARCH PROBLEM

The University of Arkansas Cotton Breeding Program attempts to develop cotton genotypes that are improved with respect to yield, host plant resistance, fiber quality, and adaptation to Arkansas environments. Such genotypes would be expected to provide higher, more consistent yields with fewer inputs. To maintain a strong breeding program, continued research is needed to develop techniques that will identify genotypes with favorable genes, combine those genes into adapted lines, then select and test derived lines.

BACKGROUND INFORMATION

Cotton-breeding programs have existed at the University of Arkansas since the 1920s (Bourland and Waddle, 1988). Throughout this time, the primary emphases of the programs have been to identify and develop lines that are highly adapted to Arkansas environments and possess good host-plant resistance traits. Bourland (2001) provided the most recent update of the current program.

RESEARCH DESCRIPTION

Each year, breeding lines and strains are tested in the University of Arkansas Cotton Breeding Program. The breeding lines are developed and evaluated in non-replicated tests, which include initial crossing of parents, individual plant selections from segregating populations, and evaluation of the progeny grown from seed of the individual plants. Once the segregating populations are established, each sequential test provides screening of genotypes to identify ones with specific host-plant resistance and agronomic performance capabilities. Selected progeny are carried forward

[1] Director and plant breeder, University of Arkansas, Northeast Research and Extension Center, Keiser.

and evaluated in replicated strain tests at multiple Arkansas locations to determine their yield, quality, and adaptative properties. Superior strains are subsequently evaluated over multiple years and in regional tests. Improved strains are used as parents in the breeding program and/or released as germplasm or cultivars. In 2001, modifications were made to accommodate second-cycle individual plant selections prior to testing as strains.

RESULTS

Breeding Lines

Crosses made in 2001 were primarily focused on improving basic yield components, reducing bract trichomes, enhancing thrips and root knot nematode resistance, and improving seedling vigor. The F_1 seed were advanced to F_2 generation during the winter. In 2001, all F_2 populations were hot-water (65C) treated, then sequentially selected for resistance to seed deterioration and bacterial blight, morphological traits and visual performance. Seed from 577 individual selected plants will be evaluated in first cycle progeny rows in 2002. In addition, 900 plants were selected from 90 advanced progeny in 2001. These will be tested as second-cycle progeny rows in 2002. From 830 second-cycle progeny in 2001, 72 were selected and will be evaluated in replicated strain tests in 2002.

Strain Evaluation

In 2001, 88 strains were evaluated in replicated strain tests at multiple locations in Arkansas. Within each test, strains were compared to standard cultivars (PSC 355 and Sure-Grow 747). Based on their performance, 36 of the strains were selected and entered into 2002 strain tests. The superior strains exhibited a wide range of lint percentages, leaf pubescence, maturity, and fiber quality. Also, eight strains were evaluated in the 2001 Arkansas Cotton Variety Test (Benson et al., 2002).

Selection Criteria

In 2001, work continued to establish selection criteria in four specific areas: Root-knot nematode resistance, thrips resistance, improved yield components, and reduced bract trichomes.

Root-Knot Nematode (RKN) Resistance

Advanced progeny and F_2 populations having RKN resistant parentage were planted in a field near Leachville, AR. High infestations of RKN and Fusarium wilt were identified in 2000. However, very low incidence of RKN injury in 2001 precluded selection for resistance. Mass selection was done in the populations, and plants will be inoculated and selected for resistance in the greenhouse.

Thrips Resistance

New and advanced strains were evaluated for yield in adjacent plots having thrips control (in-furrow insecticide) and no thrips control in 2001. Thrips infestations were relatively low, and infested plots yielded ca. 92% as much as control plots.

Yield Components

Strains were evaluated with regard to relative influence of basic yield components of seed per acre (SPA) and lint weight per seed (LPS). An additional index trait, LPS divided by seed weight, should standardize LPS for different sizes of seed. This index appeared to correlate (but the same measurement) with lint percentage. Work is continuing to determine the relationships among these traits.

Bract Trichomes

Trichomes on the teeth of bracts may influence the cleanability of cotton lint. Bract trichomes were found to be correlated with trichomes on leaves and stems, but independent assortment should be possible. Visual rating of bract trichomes was improved in 2001 by using a magnifying glass and a dark background. Environment does not appear to greatly influence the bract-trichome trait. Over three years, a cultivar-by-location interaction was only found one year when a severely stressed environment was included. In 2001 study, bract trichomes from three positions of three cultivars were counted over three dates. Trichomes declined with lower position (older bracts) on the plant, later sampling date, and as leaves of the cultivar had less trichomes. None of the 2-way or 3-way interactions were significant. These results suggest that bract trichomes of genotypes can be characterized by sampling one location (i.e., to avoid highly stressed environments) on one sampling date at one plant position. Variation in bract trichomes of breeding lines is being evaluated, and a genetic study of the trait has been initiated.

Release of Material

Six germplasm lines (Arkot 8606, Arkot 8710, Arkot 8717, Arkot 8727, Arkot 8918, Arkot 9103) were released in 2001 (Bourland and Benson, 2002a,b,c,d). Data are being summarized for additional releases in 2002.

PRACTICAL APPLICATION

Genotypes with improved host-plant resistance that are adaptable to Arkansas environments and possess good fiber quality are being developed. Improved host

plant resistance should decrease production costs and reduce production risks. Selection based on a higher reliance on lint per seed rather than seed per acre to produce yield may help to identify and develop lines having improved and more stable yield. Lines with fewer bract trichomes may reduce the amount of lint cleaning required to attain acceptable trash grades. These genotypes should be valuable as breeding material to commercial breeders or released as cultivars. In either case, Arkansas cotton producers should benefit from having cultivars that are specifically adapted to their growing conditions.

LITERATURE CITED

Benson, N.R., F.M. Bourland, A.B. McFall, J.M. Hornbeck, and F.E. Groves. 2002. Arkansas Cotton Variety Test 2001. University of Arkansas Agricultural Experiment Station Research Series 491, Fayetteville, AR.

Bourland, F.M. 2001. University of Arkansas cotton breeding program - 2001 progress report. *In:* D.M. Oosterhuis (ed.) Proc. 2001 Cotton Research Meeting and Summaries of Cotton Research in Progress. University of Arkansas Agricultural Experiment Station Special Report 204:29-34.

Bourland, F.M. and N.R. Benson. 2002a. Notice of release of Arkot 8606 germplasm line of cotton. Proc. Beltwide Cotton Conf., National Cotton Council, Memphis, TN. (In press).

Bourland, F.M. and N.R. Benson. 2002b. Notice of release of Arkot 8710 and Arkot 8717 germplasm lines of cotton. Proc. Cotton Conf., National Cotton Council, Memphis, TN. (In press).

Bourland, F.M. and N.R. Benson. 2002c. Notice of release of Arkot 8727 germplasm line of cotton. Proc. Beltwide Cotton Conf., National Cotton Council, Memphis, TN. (In press).

Bourland, F.M. and N.R. Benson. 2002d. Notice of release of Arkot 8918 and 9103 germplasm lines of cotton. Proc. Beltwide Cotton Conf., National Cotton Council, Memphis, TN. (In press).

Bourland, F. M. and B.A. Waddle. 1988. Cotton research overview–breeding. Arkansas Farm Research. 37(4):7.